reflectors may be readily extracted for use.

(7) *Certification.* Every red emergency reflector designed and constructed to comply with these requirements shall be plainly marked with the certification of the manufacturer that it complies therewith.

(j) *Requirements for fusees and liquid-burning flares.* Each fusee shall be capable of burning for 30 minutes, and each liquid-burning flare shall contain enough fuel to burn continuously for at least 60 minutes. Fusees and liquid-burning flares shall conform to the requirements of Underwriters Laboratories, Inc., UL No. 912, Highway Emergency Signals, Fourth Edition, July 30, 1979, (with an amendment dated November 9, 1981). (See §393.7(b) for information on the incorporation by reference and availability of this document.) Each fusee and liquid-burning flare shall be marked with the UL symbol in accordance with the requirements of UL 912.

(k) *Requirements for red flags.* Red flags shall be not less than 12 inches square, with standards adequate to maintain the flags in an upright position.

(49 U.S.C. 304, 1655; 49 CFR 1.48(b) and 301.60)

[33 FR 19735, Dec. 25, 1968, as amended at 35 FR 13019, Aug. 15, 1970; 35 FR 14619, Sept. 18, 1970; 37 FR 17176, Aug. 25, 1972; 40 FR 10685, Mar. 7, 1975; 41 FR 53031, Dec. 3, 1976; 47 FR 47837, Oct. 28, 1982; 59 FR 34712, July 6, 1994]

Subpart I—Protection Against Shifting or Falling Cargo

SOURCE: 38 FR 23522, Aug. 31, 1973, unless otherwise noted.

§393.100 General rules for protection against shifting or falling cargo.

(a) *Application and scope of the rules in this section.* This section applies to trucks, truck tractors, semitrailers, full trailers, and pole trailers. Each of those motor vehicles must, when transporting cargo, be loaded and equipped to prevent the shifting or falling of the cargo in the manner prescribed by the rules in paragraph (b) of this section. In addition, each cargo-carrying motor vehicle must conform to the applicable rules in §§393.102, 393.104, and 393.106.

(b) *Basic protection components.* Each cargo-carrying motor vehicle must be equipped with devices providing protection against shifting or falling cargo that meet the requirements of either paragraph (b) (1), (2), (3), or (4) of this section.

(1) *Option A.* The vehicle must have sides, side-boards, or stakes, and a rear endgate, endboard, or stakes. Those devices must be strong enough and high enough to assure that cargo will not shift upon, or fall from the vehicle. Those devices must have no aperture large enough to permit cargo in contact with one or more of the devices to pass through it.

(2) *Option B.* The vehicle must have at least one tiedown assembly that meets the requirements of §393.102 for each 10 linear feet of lading or fraction thereof. (However, a pole trailer or an expandable trailer transporting metal articles under the special rules in paragraph (c) of this section is required only to have two or more of those tiedown assemblies at each end of the trailer.) In addition, the vehicle must have as many additional tiedown assemblies meeting the requirements of §393.102 as are necessary to secure all cargo being transported either by direct contact between the cargo and the tiedown assemblies or by dunnage which is in contact with the cargo and is secured by tiedown assemblies.[1]

(3) *Option C* (*for vehicles transporting metal articles only*). A vehicle transporting cargo which consists of metal articles must conform to either the rules in paragraph (b) (1), (2), or (4) of this section, or the special rules for transportation of metal articles set forth in paragraph (c) of this section.

(4) *Option D.* The vehicle must have other means of protecting against shifting or falling cargo which are similar to, and at least as effective as, those specified in paragraph (b) (1), (2), or (3) of this section.

(c) *Special rules for metal articles*—(1) *Scope of the rules in this paragraph.* The rules in this paragraph apply to a

[1] Tiedown assemblies or dunnage in contact with sufficient exterior (including topmost) pieces of the cargo and securely holding each interior or lower piece comply with this requirement.

motor vehicle transporting cargo consisting of metal articles if that vehicle does not conform to the rules in paragraph (b) (1), (2), or (4) of this section.

(2) *Application of other sections.* A motor vehicle transporting property consisting of metal articles must, regardless of whether the rules in this paragraph apply to it, conform to the rules in § 393.102 (relating to securement systems), § 393.104 (relating to blocking and bracing of cargo), and § 393.106 (relating to front-end structure requirements).

(3) *Coils.* Whenever a motor carrier transports one or more coils of metal which, individually or as a combination banded together, weigh 5,000 pounds or more, the coils shall be secured in the following manner:

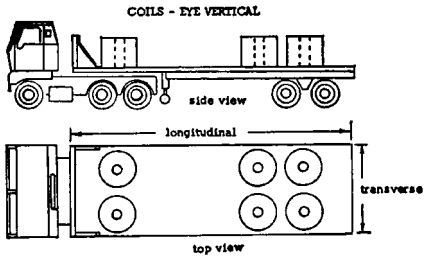
(i) *Coils with eyes vertical:* One or more coils which are grouped and loaded side by side in a transverse or longitudinal row must be secured by—

(*a*) A tiedown assembly against the front of the coil or row of coils, restraining against forward motion;

(*b*) A tiedown assembly against the rear of the coil or row of coils, restraining against rearward motion; and

(*c*) A tiedown assembly over the top of each coil or transverse row of coils, restraining against vertical motion.

The same tiedown assembly shall not be used to comply with more than one of the requirements of paragraph (c)(3)(i) (*a*), (*b*), or (*c*) of this section.



(ii) *Coils with eyes crosswise:* Each coil or transverse row of coils loaded side by side and having approximately the same outside diameters must be secured by—

(*a*) A tiedown assembly through the eye of each coil, restricting against forward motion and making an angle of less than 45° with the horizontal when viewed from the side of the vehicle;

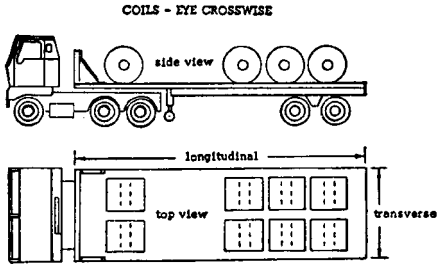
(*b*) A tiedown assembly through the eye of each coil, restricting against rearward motion and making an angle of less than 45° with the horizontal when viewed from the side of the vehicle; and

(*c*) Timbers, having a nominal cross section of 4 x 4 inches or more and a length which is at least 75 percent of the width of the coil or row of coils, tightly placed against both the front and rear sides of the coil or row of coils and restrained to prevent movement of the coil or coils in the forward and rearward directions.

(*d*) If coils are loaded to contact each other in the longitudinal direction and relative motion between coils, and between coils and the vehicle, is prevented by tiedown assemblies and timbers—

(*1*) Only the foremost and rearmost coils must be secured with timbers; and

(*2*) A single tiedown assembly, restricting against forward motion, may be used to secure any coil except the rearmost one, which must be restrained against rearward motion.



(iii) *Coils with eyes lengthwise:* A coil or transverse row of coils having approximately equal outside diameters and loaded side by side or a longitudinal row of coils having approximately equal outside diameters and loaded end to end must be secured as follows:

(*a*) The coil or coils must be restrained against side-by-side and fore-and-aft movement by—

(*1*) One or more tiedown assemblies over the top of each coil or transverse row; or

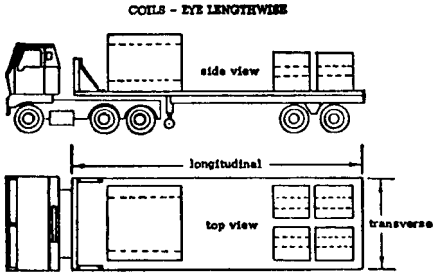
(*2*) Two or more tiedown assemblies through the eye of each coil or longitudinal row; or

(*3*) One or more tiedown assemblies, crossing from one side of the vehicle to

the other, through the eye of each coil or longitudinal row of coils in a transverse row.

(*b*) Timbers having nominal cross section of 4 x 4 inches or more must be tightly placed against the sides of each coil or against the outboard sides of each transverse row of coils which are loaded side by side so that the timbers restrain against side-to-side movement.

(*c*) If, in accordance with paragraph (c)(3)(iii)(*a*)(*1*) of this section, only one tiedown assembly over the top of each coil or transverse row of coils is used to restrain against side-to-side movement and fore-and-aft movement, timbers having a nominal cross section of 2 x 4 inches or more and which are firmly secured to longitudinal blocking must be tightly placed against the front and back of each coil, each longitudinal row of coils, and each transverse row of coils in a manner which restricts forward and rearward movement.



(iv) Timber which is used for blocking must be sound lumber which is free of defects (such as knots or cracks) that materially reduce its strength.

(v) Timbers need not be used on vehicles which have depressions in the floor or are equipped with other restraining devices which perform the functions specified for timbers by the rules in this section.

(vi) As used in this section, the term ''nominal'', when used to describe timber, means commercially dressed sizes generally designated by the dimensions indicated.

(4) *Miscellaneous metal articles.* Except as provided in paragraph (c)(4)(iv) of this section, whenever a motor carrier transports metal articles consisting of cut-to-length bars, plates, rods, sheet and tin mill products, billets, blooms, ingots, slabs, structural shapes, or pipe, and other tubular products and those articles, either individually or as a combination of articles banded or boxed together and handled as a single unit, weigh more than 2,000 pounds, the article shall be secured in the following manner:

(i) A single article, a group of articles, or a combination of articles loaded side by side across the width of the vehicle must be secured by at least one tiedown assembly over its top for at least every 8 feet of its length and at least two tiedown assemblies securing each individual article or combination of articles banded or otherwise secured together and handled as a single unit. However, articles which individually have a length of 8 feet or less and which are securely butted against each other in the fore-and-after direction may be secured by metal angles secured by tiedown assemblies, or they may be secured by a timber having a nominal cross section of 4 x 4 inches or more placed longitudinally over the articles and secured by tiedown assemblies. Tiedown assemblies may not be located beyond the ends of the article which they secure.

(ii) If articles are tiered and each tiered article rests securely on the one beneath it, the tier may be secured in the same manner as a single level of those articles is secured in accordance with the rules in this section.

(iii) Pole trailers must either comply with the requirements of paragraph (c)(4) (i) and (ii) of this section or have at least two tiedown assemblies securing the load to the forward bolster and at least two tiedown assemblies securing the load to the rear bolster.

(iv) The rules in this paragraph do not apply to special loads consisting of machinery or fabricated structural items, such as beams, girders, and trusses, which are fastened by special methods. However, those loads must be securely and adequately fastened to the vehicle.

(d) *Special rule for special-purpose vehicles.* The rules in this section do not apply to a vehicle transporting one or more articles which, because of their size, shape, or weight, must be carried on special-purpose vehicles or must be

fastened by special methods. However, any article carried on that vehicle must be securely and adequately fastened to the vehicle.

(e) *Special rule for intermodal cargo containers.* Containers designed for the transportation of containerized, intermodal cargo and having integral securement devices must be fastened to the chassis of the motor vehicle with securement devices that prevent them from being unintentionally unfastened. The securement devices must restrain the container from moving more than one-half inch forward, more than one-half inch aft, more than one-half inch to the right, more than one-half inch to the left, or more than one inch vertically when the container is subjected to the following accelerations relative to the vehicle:

Direction of force relative to longitudinal axis of vehicle	Acceleration in G's
Downward	1.70
Upward	0.50
Lateral	0.30
Longitudinal	1.80

(f) *Effective date.* This section is effective on October 1, 1973.

§ 393.102 Securement systems.

(a) *Application and scope of the rules in this section.* The rules in this section apply to tiedown assemblies (including chains, cables, steel straps, and fiber webbing), other securement devices, and attachment or fastening devices used in conjunction therewith, which are used to secure cargo to motor vehicles in transit. All devices which are used to secure cargo to a motor vehicle in transit under the rules in this subpart must conform to the requirements of this section.

(b) *Tiedown assemblies.* Except for integral securement devices of containers designed for the transportation of containerized, intermodal cargo which conform to the rules in § 393.100(e), the aggregate working load limit of the tiedown assemblies used to secure an article against movement in any direction must be at least 1/2 times the weight of the article. With the exception of marking identification, tiedowns used must meet applicable manufacturing standards listed in this paragraph (b).

(1) *Steel strapping.* Steel strapping used as a component of a tiedown assembly must conform to the requirements of the 1991 edition of the American Society for Testing and Materials' Standard Specification for Strapping, Flat Steel and Seals, ASTM D3953–91. Steel strapping which is not marked by the manufacturer with a working load limit, shall be considered to have a working load limit equal to 1/4 of the breaking strength listed in ASTM D3953–91. (See § 393.7(b) for information on the incorporation by reference and availability of this document.) Steel strapping that is one inch wide or wider must have at least two pairs of crimps in each seal and when an end-over-end lap joint is formed, it must be sealed with at least two seals.

(2) *Chain.* Chain used as a component of a tiedown assembly must conform to the requirements of the June 15, 1990, edition of the National Association of Chain Manufacturers' Welded Steel Chain Specifications applicable to all types of chain. (See § 393.7(b) for information on the incorporation by reference and availability of this document.)

(3) *Webbing.* Webbing used as a component of a tiedown assembly must conform to the requirements of the 1991 edition of the Web Sling and Tiedown Association's Recommended Standard Specification for Synthetic Webbing Tiedowns. (See § 393.7(b) for information on the incorporation by reference and availability of this document.)

(4) *Wire rope.* Wire rope used as a component of a tiedown assembly must conform to the requirements of the November 1985 second edition of the Wire Rope Technical Board's Wire Rope Users Manual. Wire rope which is not marked by the manufacturer with a working load limit, shall be considered to have a working load limit equal to ¼ of the nominal strength listed in the Wire Rope Users Manual. (See § 393.7(b) for information on the incorporation by reference and availability of this document.)

(5) *Cordage.* Cordage used as a component of a tiedown assembly, must conform to the applicable Cordage Institute rope standards listed below: PETRS–2, Polyester Fiber Rope, 3-Strand and 8-Strand Constructions,